

Attorney Docket No.: T7106(C)
Serial No.: 10/583,230
Filing Date: June 16, 2006
Confirmation No.: 8226

REMARKS

Election/ Restrictions

Claims 7-12 have been withdrawn following an election with traverse in response to restriction requirement mailed January 23, 2009.

Drawings

Since claim 3 has been canceled without prejudice the Examiners requirement for a drawing showing 50,000 microfluidics reactors in rendered moot.

Amendments to the Claims

Claim 1 has been amended without prejudice to recite language set forth in the specification which more clearly distinguishes the invention from the prior art.

Amended claim 1 specifies that the microfluidic system comprising at least a first and second microfluidic reactors arranged in parallel as disclosed page 7, lines 4-11, page 15, lines 14 to page 16, line 7 and Figures 1 and 2.

Amended claim 1 also specifies that that the reactors are fed via an upstream channel or channels, said upstream channel or channels positioned before the microfluidics reactors as disclosed page 15, line 24 and Figure 1, and page 9 lines 4-5.

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Amended claim 1 further specifies that the at least one downstream channel is positioned after the reactors as disclosed on page 9, lines 7-8.

Claim 3 has been canceled without prejudice.

Claim Rejections – 35 USC § 112

Claims 2 and 3 were rejected under 35 USC § 112, first paragraph. The Examiner asserted that while the specification provided enablement for “first and second microfluidics reactors, it does not provide enablement for 1,000 microfluidis reactors”. Applicants respectfully disagree for the reasons set forth below.

Applicants invention is directed to the objective of providing “*a fluid distribution system, allowing to feed several fluid phases to any number of parallel microfluidic units from a single or multiple source for each phase, with substantially the same pressure at the inlet port of each of the microfluidic units, and stability of the flow to small pressure fluctuations or small differences between the resistance of each of the microfluidic units*”. Page 7, lines 44-11 – Emphasis added

Applicants’ respectfully draw the Examiners attention to the following passages of the specification which applicants submit provides adequate guidance to a person of ordinary skill in the art to which the subject matter pertains (e.g., graduate physical chemist, chemical engineer or physicist with several years of experience in fluids mixing) to make and use a microfluidics system that includes 1,000 microfluidis units:

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Page 10, lines 27-29 which teaches that in a preferred embodiment

“all microreactors in the system are fed from single source units feeding all upstream channels. Therefore in a preferred embodiment, the upstream channels are divided into a multitude of upstream channels in nodes to feed a multitude of microfluidic reactors”.

Page 12, line 8 to page 13, line 10 which teaches that

“Preferably the microfluidic system comprises at least 3 layers.

The first layer comprises at least two main inlet channels for fluid supply, and at least 1 outlet channel. This layer is also referred to as inlet/outlet layer. The inlet and outlet channels are preferably arranged parallel. Their internal diameter is preferably from 0.1 micrometer to 500 micrometer more preferred from 10 to 250 micrometer.

The channels may be fabricated using a variety of techniques, such as conventional moulding, drilling and the like. The base material for the first layer is preferably selected from the group comprising stainless steel, glass or polymer such as plastic, or a combination thereof.

The connecting layer is preferably positioned between the inlet/outlet layer and the microfluidic layer. The connecting layer comprises a plurality of side channels with varying diameter and/or length. This difference in diameter/length enables control over the pressure and flow rate conditions experienced by the microfluidic elements connected to the channels of the connecting layer.

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The material that is the basis of the connecting layer is preferably selected from the group comprising stainless steel, glass or polymer such as plastic, or a combination thereof.

The third layer is the microfluidic layer, which comprises a plurality of microfluidic reactors. These reactors are connected to the connecting channels via a port and through the connecting channels they are in fluid connection with the main channels that provide the feeding material.

The material of which the microfluidic layer is prepared is preferably selected from the group comprising polymers, glass, steel or silicon, or combinations thereof".

Page 15, line 14 to page 16, line 8 which teaches

The simple microfluidic network presented in Figure 1/2 can be generalized in the following way. A more complex microfluidic network involving the parallel action of at least 2 reactors receiving at least 2 different fluids from at least 2 external sources, with exactly one source per fluid, will require the following elements:

- (i) inlets and outlets for the fluids*
- (ii) "splitting node" splitting the fluids coming from the inlets to the various micro-processing elements.*

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- (iii) *upstream channels, located between the split and the points where the various fluids meet. These upstream channels are optionally used in the processing, for example for cooling, heating, or otherwise processing the inlet fluids before they join.*
- (iv) *joining nodes, where the fluids from the at least two sources meet and start to interact; these joining nodes may be the reactors.*
- (v) *Downstream channels, located after the joining node, respectively after the reactors, and leading to either the outlets or any collecting channel or gutter which collects the output from the various processing elements. The downstream channels are optionally used to further process the at least two fluids together”.*

In light of the above disclosures found in the specification as filed, applicants respectfully request that the Examiner reconsiders and withdraws the §112, first paragraph rejection.

Claim Rejections – 35 USC § 103

Claim 1-6 were rejected under 35 USC 103(a) as being unpatentable over Allen et al (WO 01/128670). Applicants’ respectfully request that the Examiner reconsider this rejection in light of the above amendments and following remarks.

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Statement of Facts

As discussed above, applicants invention is directed to the objective technical problem of providing “a fluid distribution system, allowing to feed several fluid phases to any number of parallel microfluidic units from a single or multiple source for each phase, with substantially the same pressure at the inlet port of each of the microfluidic units, and stability of the flow to small pressure fluctuations or small differences between the resistance of each of the microfluidic units”. Page 7, lines 44-11

Applicants found that “when the resistance of the upstream channel or channels is 10 times higher, preferably 100 times higher than the resistance of the down stream channel or channels, the influence of small variations in flow rate in either of these channels is limited and hence a more robust system is provided”. Page 9, lines 15-20 and 22-4

According to applicants’ invention upstream channels are the channels that are positioned before the microfluidic reactors while downstream channels are the channels that are positioned after the reactors and hence after two fluid streams have met. Page 9, lines 4-8.

Allen “relates to a fluidic mixer that mixes two fluids without using mechanical stirrers. The two fluids are fed into an interaction cavity under predeterminable conditions that ensure the fluid flows oscillate and feed in an alternating manner two exit channels. The fluids in the exit channels form interleaved layers having widths related to the frequency of oscillation. The fluid have relatively Reynolds low numbers and preferably Reynolds numbers that are less than 100” (Abstract)

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Allen is silent concerning the problem of devising a microfluidics distribution system that is more stable to small pressure fluctuations and shows reduced occurrence of multiphase shunts. Allen is silent about the influence on this problem of the relative resistance of liquids in upstream channels, and downstream channels when connecting two or more parallel reactors.

Applicants Arguments

The Examiner citing Fig 2a, parts **222** and **224**, asserted that Allan inherently discloses an assembly in which the resistance of the upstream channel is greater than the resistance of the downstream channel because the diameter of part **222** and **224** is smaller than the diameter of the “downstream channel” ,e.g., item **112** and **114**.

Applicants respectfully point out that parts **222**, **224**, are the “nozzle channels” of the first and second nozzles **106** and **108**” (Allan page 4, lines 17 and 18). The, features **222** and **224** are part of the microfluidic reactor as clearly demonstrated in Figure 6 of Allan (enclosed in the circles designated **606** and **618** and described on page 13, lines 21-23). Thus, these features can not be “upstream channels which must be positioned before the microfluidics reactors and are not part of the reactor. See also applicants’ Figure 1 items α , β and Figure 2 items **5-8**.

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The parts of the Allen system which corresponds to applicants "upstream channels" (the channel positioned before the microfluidics reactors) are the inlets designated as parts **102** and **104** whose diameters are of comparable size to the down stream channels **112** and **114** and thus, would be expected to have comparable resistances (see Fig 1 and 2a).

The objective technical problem addressed by applicants and solved by claim 1 is a microfluidics distribution system that is more stable to small pressure fluctuations and shows reduced occurrence of multiphase shunts. The solution which applicants discovered was to insure that the resistance of the upstream channel or channels is 10 times higher than the resistance of the down stream channel or channels, preferably 100 times higher.

In contrast, Allan is directed to the problem of more efficient mixing of reactant in microchemistry (page 1, line 7-8). This problem is solved by Allan through modification of the design of the reactor. The problem of a distribution system which feed an array of parallel reactors is not mentioned nor is the problem of a distribution system which is more stable to small pressure fluctuations and shows reduced occurrence of multiphase shunts.

Furthermore, Allan is silent regarding any limitations on the resistances of the upstream and downstream channels of the distribution system.

Thus, Allan is silent about both the technical problem addressed by applicants and the "result-effective parameters" which are involved, i.e., the relative resistance of

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the liquid in the upstream channel vs the downstream channel of the microfluidics reactor.

MPEP 2144.05 IIB states that only result-effective variables can be optimized: "A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation".

Applicants respectfully submit that the Examiner has used the knowledge gained from applicants' disclosure as a blueprint in an attempt to reconstruct their claimed invention from an isolated piece of prior art. This approach contravenes the statutory mandate of §103 which requires judging obviousness at the point in time when the invention was made. *Grain Processing v. American Maize-Prods. Co.*, 840 F.2d 902, 907 (Fed. Cir. 1988).

Absent a disclosure of the limitation that the resistance of the upstream channel or channels is 10 times higher than the resistance of the down stream channel or channels, preferably 100 times higher, Allen does not teach or suggest all of the limitations recited in applicants' claimed invention as required for obviousness under §103(a). Furthermore, absent a disclosure that relative resistance in these channels is a "results-effective variable" in microfluidic systems comprising multiple parallel reactors, the limitations recited in claim 1 and claims depending there from can not be considered as derivable from Allen by routine experimentation.

In view of the foregoing amendment and remarks, applicants respectfully request that the application be allowed to issue.

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If a telephone conversation would be of assistance in advancing prosecution of the subject application, applicants' undersigned agent invites the Examiner to telephone him at the number provided.

Respectfully submitted,

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